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# LARYNGOSCOPE FOR USE IN TRACHEA INTUBATION

by

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## BACKGROUND OF THE INVENTION

### 5 FIELD OF INVENTION:

This invention relates generally to fiberoptic scopes and more particularly to a laryngoscope having <sup>such a scope with</sup> an associated ~~integral~~ lightweight portable screen, <sup>said laryngoscope is</sup> particularly useful in a procedure for intubating a patient's trachea, especially in emergency situations.

### 10 RELEVANT PRIOR ART:

A fiberoptic intubating <sup>instrument having thereon a</sup> scope with a camera and <sup>an associated</sup> lightweight portable screen was disclosed by Dr. Gordon George in US Patent 5 363 838 which issued on November 15, 1994. Dr. George had also authored US Patent 4 742 819 which had issued on May 10, 15 1988 wherein he had likewise disclosed a prior version of an intubating <sup>instrument having thereon a</sup> scope with a camera and <sup>a</sup> screen associated therewith.

United States Patent 4 086 919 to Bullard disclosed a laryngoscope having a single eyepiece attached to the laryngoscope blade. The eyepiece is illuminated by a fiberoptic system. If the intubator looks through the Bullard scope and has to remove his eyes from the eyepiece to make an external assessment of the airway of the patient, a critical lag in time occurs before the <sup>Professional intubator</sup> intubator can re-focus on the internal images seen through the eyepiece. The

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G/

critical lapse of time caused by the process of focusing and re-  
focusing can affect timely placement of the endotracheal tube and  
may even cause the <sup>Professional Intubator</sup> ~~intubator~~ to misinterpret certain landmarks,  
hindering correct placement of the endotracheal tube. Most  
5 importantly, movement of the <sup>Professional Intubators</sup> ~~intubator's~~ body and head, down to and  
away from the eyepiece, can lead to erroneous placement of the  
endotracheal tube in a structure other than the patient's airway.  
Such erroneous placement can result in death or serious brain  
damage to the patient, so importance of correct endotracheal tube  
10 placement cannot be overemphasized.

#### DISCUSSION OF PROCEDURE:

<sup>DNS 92</sup>  
<sup>a</sup>  
In performing an intubating procedure, <sup>a2</sup> ~~usually a~~  
~~physician, nurse or emergency medical technician~~ (each  
~~hereinreferred to as the "intubator"~~) holds a laryngoscope in one  
15 hand for lifting the patient's tongue to one side to expose the  
<sup>patient's</sup> trachea opening and the <sup>a3</sup> ~~intubator~~ operates an intubating instrument  
in his or her other hand. In performing the procedure the  
<sup>DNS 93</sup>  
<sup>DNS 94</sup> <sup>Professional Intubator</sup> <sup>a4</sup> ~~intubator~~ usually must move and manipulate the intubating  
instrument which necessarily would moves and disturbs a <sup>scope or</sup> camera  
20 <sup>if it were</sup> mounted thereon. Thus the movement <sup>would</sup> disturbs and disrupts display  
of the patient's oral internal structures that <sup>would</sup> appear on the  
screen of Dr. George. <sup>a5</sup> ~~The intubator's~~ hand holding the  
laryngoscope to keep the patient's tongue out of the intubator's  
line of sight, stays steady and constant. So Applicant here  
<sup>a</sup> 25 teaches to mount the <sup>scope or</sup> camera in the vicinity of the distal end of

the blade of the laryngoscope, instead of on the intubating instrument, whereby display of the patient's oral internal structures remains quite steady while the <sup>Professional</sup> Intubator's other hand is free to move and manipulate the intubating instrument in inserting <sup>the tube</sup> it into the patient's trachea.

It is necessary frequently in medical procedures to insert an endotracheal tube into the trachea of a patient for ventilation, oxygenation and/or airway protection. Intubation is often difficult and can give rise to complications. It is <sup>frequently</sup> ~~often~~ performed in critical and life-threatening situations on severely compromised patients in awkward emergency sites. Even a short period of oxygen deprivation can result in death or severe brain damage of the patient. A common <sup>ingredient</sup> cause for failure when attempting intubation is <sup>that</sup> when the <sup>Professional</sup> Intubator's view of the patient's tracheal opening <sup>becomes</sup> is obstructed. That situation of obstructed view is called blind intubation. The most common cause of blind intubation is that the tongue slips over the laryngoscope blade and obstructs the <sup>Professional</sup> Intubator's view of the tracheal opening. The tongue being large, floppy, moist and slippery, easily does slip over the laryngoscope blade and down into the line of vision between the <sup>Professional</sup> Intubator and the tracheal opening. Additionally, sometimes neck type and abnormalities of the patient's pharynx, such as abscesses, cancers and even congenital abnormalities can result in an inability to see directly the tracheal opening, thus resulting in failure of intubation.

In many patients establishment of the airway may be a formidable task due to morphologic anomalies such as a large tongue, excessive pharyngeal or laryngeal soft tissue or tracheal displacement, as well as physiologic events such as laryngospasm, regurgitation of gastric materials, blood or foreign bodies. The morphologic anomalies already mentioned make it difficult to visualize the posterior pharyngeal area and larynx. The present invention helps minimize risks brought on by such anomalies.

In terms of neck type, short necks cannot extend fully whereby the <sup>Professional</sup> Intubator's direct line of vision (180° angle) is not achieved between the <sup>Professional</sup> Intubator's eye and the tracheal opening and there is blind intubation. Blind intubation <sup>unfortunately</sup> is rarely successful.

The laryngoscope blade is easily passed, conventionally using the <sup>Professional</sup> Intubator's left hand, behind the base of the tongue and into the pharynx. The endotracheal tube is also passed, conventionally using the <sup>Professional</sup> Intubator's right hand, behind the base of the tongue and into the pharynx. The laryngoscope <sup>with its</sup> blade (once positioned) <sup>is</sup> are held, by the <sup>Professional</sup> Intubator's left hand, in a steady and firm minimally changing position. The endotracheal tube is moved in varying positions by the <sup>Professional</sup> Intubator's right hand to enter the tracheal opening. The laryngoscope according to the present invention is a modification of current state of the art laryngoscopes such that a <sup>scope or</sup> camera is mounted on its distal end, preferably at or in the vicinity of the far tip of the laryngoscope blade, <sup>preferably</sup> spaced <sup>slightly</sup> rearwardly therefrom. The camera is operatively connected to a screen which can be attached (preferably pivotally)

to the handle of the laryngoscope just above the blade insertion, so that the <sup>professional</sup> intubator's direct view into the mouth and simultaneous view of the screen can be achieved with no head movement by the <sup>professional</sup> intubator and minimal change in his or her line of vision - that is to say, eye movement. When the laryngoscope is positioned it is held in a substantially stable condition so that the <sup>scope or</sup> camera is steady and the screen displays a stable picture whereby <sup>in section</sup> placement of the intubating instrument <sup>into the patient's trachea</sup> and the <sup>venous</sup> endotracheal intubating procedure are greatly facilitated.

Once the laryngoscope blade, <sup>scope or</sup> camera and screen are steadied, the endotracheal tube is passed easily and conveniently into the posterior pharynx. As it passes the camera's eye the endotracheal tube appears on the screen so <sup>then</sup> ~~at that point~~ the <sup>professional</sup> intubator has the tube and the tracheal opening both in simultaneous view on the screen. <sup>professional</sup> The <sup>aid</sup> intubator then has the endotracheal tube distal end and the tracheal opening on the screen and bringing the two together becomes a simplified and relatively relaxed procedure. <sup>att</sup>

Fiberoptic scopes have been used in association with screens, video systems, tapes and discs in other areas of medicine as well. Scopes used for arthroscopy with screens set on a monitor off to one side of <sup>an</sup> the operating room table are just one example. Another example is use of a fiberoptic scope in performance of laparoscopic cholecystectomy. <sup>The</sup> ~~Again~~ the screen and with it the monitoring images <sup>is</sup> are removed from the direction of the operation. To use such fiberoptic scopes and devices for intubation of a

trachea, especially in patients who present airways that are complicated, is not an optimal answer <sup>for</sup> ~~to the~~ emergency intubation situation. If such a scope is inserted <sup>Q12</sup> through the endotracheal

tube to view the patient's airway structures, as the endotracheal tube <sup>go</sup> goes out of sight the <sup>professional</sup> intubator has to turn his or her head and/or body in a significant manner to view the associated screen.

If <sup>mouth and throat</sup> structures are seen that are not easily identifiable, the

<sup>professional</sup> intubator then has to turn his or her head and/or body back to the direct viewing of the airway to see just where the endotracheal

tube is placed, and make an adjustment of the endotracheal tube in the airway in relation to anatomic structures that are present.

Then as the endotracheal tube goes out of sight again, the <sup>professional</sup> intubator has to turn his or her head and body off to the side to

again look at the screen. Because <sup>air</sup> ~~a~~ physician cannot simultaneously view the airway directly and indirectly through the

screen, confusion, lack of orientation of the endotracheal tube and its proper position in the airway can result, potentially leading to failure in an emergency intubating process.

The invention set forth in Dr. George's Patent 5 363 838

entitled "Fiberoptic Intubating Scope with Camera and Lightweight Portable Screen and Method of Using Same" comes close to achieving optimum conditions to assuring quick, accurate and easy placement of the endotracheal tube in a patient's trachea. The present

invention ~~also allows the physician simultaneously to see the~~ <sup>Q15</sup>

patient's airway directly and indirectly ~~through the scope via the~~ <sup>as a steady picture on</sup> camera and screen. The present invention likewise <sup>enable</sup> allows the

<sup>Professional</sup>  
^ intubator to move his or her eyes <sup>ONLY</sup> minimally during the intubating procedure so that he or she does not have to turn his or her head or body to visualize indirectly the airway, as would be required with a screen that <sup>were</sup> is set off to the side and not close to the  
5 direct line of vision of the task at hand.

Normally <sup>a Professional is either</sup> an intubator <sup>is</sup> right-handed or left-handed, which is to say he or she has a dominant hand and a less-dominant hand. Normally the <sup>Professional</sup> intubator would be inclined to use his or her less-dominant hand to hold the laryngoscope, because <sup>the less-dominant hand</sup> it is  
10 sufficient for lifting and moving to one side the patient's tongue steadily and constantly during the intubation procedure. Traditionally <sup>Professional</sup> intubators have been trained to hold a laryngoscope in his or her left hand, but that tradition is not carved in stone. Because the less-dominant hand and the blade of the laryngoscope  
15 are easily held steady, the field of view which the <sup>Scope or</sup> camera observes likewise is <sup>quite</sup> relatively steady. The dominant hand <sup>like</sup> with superior agility, then is available to manipulate the intubating instrument without <sup>bouncing</sup> disturbing or disrupting the display on the screen.

#### SUMMARY OF THE INVENTION

20 A primary object of the present invention is to provide a laryngoscope for use with an intubating instrument in a procedure for intubating a trachea of a patient, especially a patient whose pharynx, larynx and trachea are not easily visualized.

25 A further object is to provide such a laryngoscope which is user-friendly to the <sup>Professional</sup> intubators.

A further object is to provide a laryngoscope with a <sup>SCOPE OR</sup> camera and display screen which do not require the <sup>Professional</sup> intubator to turn his or her head away from the direct <sup>visualization of the operating</sup> visual field during the intubation procedure.

5 A further object of the invention is to provide such a laryngoscope which can be set up quickly and easily.

A further object of this invention is to provide such a laryngoscope which is self-contained, lightweight and portable.

10 A further object of the invention is to provide such a laryngoscope which allows the <sup>Professional</sup> intubator to see simultaneously more superficial structures of the oral pharynx by direct vision and the deeper structures of the larynx and trachea indirectly through the <sup>Q17</sup> displaced screen.

<sup>Q17</sup> 15 A further object of the invention is to enable the <sup>Professional</sup> intubator to lift and move aside the patient's tongue and position the camera steadily and constantly during the <sup>Q18</sup> procedure with his or her less-dominant hand, thereby allowing the <sup>Professional</sup> <sup>intubation</sup> intubator to manipulate the intubating instrument with his or her dominant hand.

<sup>Q19</sup> 20 These and other objects and advantages will be apparent to those skilled in the art in light of the following disclosure, claims and accompanying drawings.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Throughout the drawings the same reference characters indicate the same or similar parts.



Fig. 1 is an illustration of the patient laying flat on a suitable platform with his or her neck drawn back and the Professional<sup>Professional</sup> intubator positioned behind the patient's head. The Professional<sup>Professional</sup> intubator may be a physician, nurse, Paramedic<sup>Paramedic</sup> or an emergency medical technician. The Professional<sup>Professional</sup> intubator is using his or her left hand to insert the blade of the laryngoscope into the patient's mouth while drawing the patient's neck back.

Fig. 2 illustrates the laryngoscope in its functioning position, to offer the Professional<sup>Professional</sup> intubator a direct line of vision to the patient's trachea opening and other oral internal structures near thereto.

Fig. 3 illustrates insertion of the intubating instrument into the trachea of the patient.

Fig. 4 is a circuit showing the operative relationships of the Scope or<sup>Scope or</sup> camera means, the power supply means and the display means.

Referring to Fig. 1 patient 11 is arranged on a platform (not shown) with a Professional<sup>a Professional</sup> intubator 12 taking a position behind the patient's head 13 so that the Professional<sup>Professional</sup> intubator can have a direct line of sight 14 directly down the patient's throat 15. The neck 16 of the patient 11 is drawn rearwardly to enable the Professional<sup>A Professional</sup> intubator 12 to see more clearly down the patient's throat. With his or her left hand the Professional<sup>Professional</sup> intubator 12 inserts a blade 17 of a laryngoscope 18 into the patient's mouth 19 and gently draws and rotates the handle 21 of the laryngoscope 18 toward the Professional<sup>Professional</sup> intubator 12 and lifts the patient's tongue 22 moving it to one side whereby the Professional<sup>Professional</sup> intubator 12 now is

afforded a direct line of sight through the patient's mouth down the patient's throat 15 to his or her pharynx and the area of the patient's trachea opening 23.

Referring to Fig. 2, the laryngoscope 18 includes the handle 21 with the blade 17. The blade 17 has a proximal end 24 and a distal end 25. A <sup>scope or</sup> camera 26 is mounted on the blade 17 in the vicinity of the distal end 25 for observing a visual field 27 which includes <sup>mouth and throat</sup> ~~oral~~ internal structures associated with the trachea opening 23. The camera 26 could be at the tip 28 of the blade 17, but that would be disadvantageous if the tip 17 <sup>were to get</sup> gets involved in one soft tissue obstruction or another. Under ideal circumstances a highly skilled <sup>professional</sup> intubator 12 can distinguish and manipulate various structures, such as the patient's epiglottis. In emergency circumstances, taking into account various levels of skill of <sup>professional</sup> intubators, the crucial objective is to afford reliable placement of the intubating instrument into the trachea opening 23, rather than have it pass into the patient's esophagus 31. So the <sup>scope or</sup> camera 26 is located strategically best to see the trachea opening 23 whereby the intubating instrument can be inserted reliably therein.

The camera 26 (shown best in Fig. 4) is powered by a battery 32 <sup>preferably</sup> in the handle 21 and a suitable on-off switch 33 is provided. The display means is shown as a television screen 34 mounted on the handle 21 and <sup>may be</sup> arranged to swivel as indicated in Figs. 2 and 3. <sup>as</sup> The battery 32 can be recharged in the usual way. Alternately the laryngoscope 18 could be powered via a hard wire or plug-in connection to another power source.

a  
The laryngoscope 18 preferably is made of lightweight hard plastic and the blade 17 is detachable for sterilization. Communication of the <sup>scope or</sup> camera 26 with the screen 34 is conveniently provided through a fiber optic tube 35 via optic fibers as is well-known in the art. It is also envisioned that the camera means 26 could comprise a computer chip camera or similar camera means now in development.

By positioning the display screen 34 on the handle 21 of the laryngoscope 18 and enabling it to swivel, as best seen in Fig.

10 3, the intubator 12 can simultaneously view the area of the trachea opening 23 directly and on the screen 34 without substantial motion

of the <sup>Professional</sup> intubator's <sup>12</sup> eye 14. The <sup>Professional</sup> intubator's <sup>12</sup> right hand 36 is free to move and manipulate the intubating instrument 29 to guide it

into the patient's trachea 23, rather than the patient's esophagus

15 31. The <sup>scope or</sup> camera 26 remains steady on the <sup>relatively</sup> stationary blade 17 of the laryngoscope 18 and is held firmly by the <sup>Professional</sup> intubator's <sup>12</sup> left hand 37,

so the visual field 27 seen by the camera 26 does not <sup>bounce around</sup> move with the <sup>VA 22</sup> intubating instrument 29. The display on the screen 34 clearly

depicts the trachea opening 23 and related structures and the

a 20 <sup>Professional</sup> intubator 12 sees the intubating instrument 29 passing into the trachea opening 23 both directly with his or her straight line of sight and also on the display screen 34 positioned quite close thereto.

It will be understood by those skilled in the art that various deviations may be made in the shown preferred embodiment

without departing from a main theme of invention set forth in claims which follow.